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ABSTRACT

A curriculum alignment chart is presented that translates mathematics goals/indicators into related vocational skills for the energy and power course in the secondary vocational education curriculum. The chart contains three columns that correlate (1) vocational education performance indicators, (2) vocational education competency and mathematics skill/concept, and (3) relevant mathematics competency indicators. A page that corresponds to the chart provides suggestions for instructing students in the skills listed on the chart and activities that might be appropriate. These activities may be sample test items and/or practical applications of skills learned. (YLB)

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CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 003 01. Define work. 02. Define horsepower. 03. Define kilowatt-hour. 04. Define potential energy. 05. Define kinetic energy. 06. Define power. 07. Define energy.	003 Distinguish among energy, power, and other items, e.g., work, horsepower. SKILLS: Multiplication Division Addition Subtraction	INTRODUCTORY ALGEBRA (PART ONE) 1.06 Evaluate formulas when replacement values are given 8.04 Use the multiplication property of equality to solve linear equations 8.05 Use the division property of equality to solve linear equations 8.12 Use formulas to solve practical problems INTRODUCTORY ALGEBRA (PART TWO) 7.06 Use addition and subtraction to solve a system of equations 7.07 Use multiplication to solve a system of equations GENERAL MATHEMATICS 11.06 Find the missing term in a formula when sufficient information is given ALGEBRA I 6.02 Solve a simple equation by using the addition property of equality

VOCATIONAL EDUCATION COURSE Energy and Power Technology

003

INSTRUCTIONS TO STUDENTS: Match the words to their definition by placing the correct letter to the left of the numbers.

E	1. work	a. A unit of work or energy equal to one kilowatt in one hour.
H	2. horsepower	b. The energy of motion.
F	3. heat	c. The amount of heat required to raise the temperature of one gram of water, one degree celsius.
C	4. calorie	d. Unit of electrical power.
D	5. watt	e. Force x distance.
A	6. kilowatt-hour	f. Measured in calories or BTU's.
I	7. potential energy	g. The flow of electricity.
B	8. kinetic energy	h. 550 hp of work per second.
K	9. power	i. Stored heat or energy.
J	10. energy	j. Ability to do work.
		k. Rate at which work is done.

INSTRUCTIONS TO STUDENTS: Place a (K) beside the number that describes kinetic energy. Place a (P) beside the number that describes potential energy.

P 1. stored energy

K 2. the energy of motion

P 3. energy not in motion

K 4. work due to motion

INSTRUCTIONS TO STUDENTS: Place an (E) beside the units of energy and a (P) beside the units of power.

E 1. BTU

E 2. kilowatt-hours

P 3. watts

E 4. calories

P 5. calories per second

P 6. horsepower

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CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 006 01. Demonstrate a manometer. 02. Demonstrate a micrometer. 03. Demonstrate a galvonometer.	006 List the basic systems, units, and instruments used to measure energy and power. SKILLS: Measurement Metric Multiplication	GRADE 8 2.08 Multiply two decimal numbers 3.10 Multiply two proper and/or improper fractions 6.02 Determine the length, width, or height of an object or drawing by measuring to the nearest millimeter or eighth of an inch GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 3.16 Multiply two fractional numbers 3.18 Multiply two mixed numbers 5.01 Measure the length of an object to the nearest centimeter HEATH LEVEL 2 9-3 Measure using the metric system. 9-4 Measure using the customary system. HEATH LEVEL 6 9-6 Measure lengths with a 1/16-inch ruler.

VOCATIONAL EDUCATION COURSE Energy and Power Technology

006

INSTRUCTIONS TO STUDENTS: Complete the statement by writing in the missing words in the space provided.

The two systems used to measure energy is the English system and the Metric system.

INSTRUCTIONS TO STUDENTS: Complete the statement by writing in the missing word in the space provided.

Newtons (pounds) measure how much work can be taken from energy.

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing correct information in the space provided.

What does a manometer measure? vacuum in water or mercury

What does a micrometer measure? distance

What does a galvanometer measure? small electrical current

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CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 026 01. Bend electrode, file with point file, use fuel guage to set correct gap. 02. Check condensor, coil, and plunger for operational condition. 03. Find measurement of bore sizes for taper and/or roundness. 04. Identify device needed to check an engine for power outage.	026 Demonstrate how small internal combustion engines are serviced, diagnosed, disassembled, measured, repaired, assembled, and checked for performance. SKILLS: Decimals Fractions Measurement Multiplication Division	GRADE 7 1.01 Read word names for whole numbers containing as many as seven digits 1.02 Read and write the numeral for any whole number less than ten million 4.01 Read and write decimals through thousandths GRADE 8 2.01 Read and write numbers with as many as three decimal places 3.01 Read and write fractions with more commonly used denominators, e.g., 2, 3, 4, 5, 6, 8, 10, 12, 20, 25, 50, and 100 3.07 Convert fractions into decimal numbers 3.08 Convert decimal numbers into fractions 6.02 Determine the length, width, or height of an object or drawing by measuring to the nearest millimeter or eighth of an inch INTRODUCTORY ALGEBRA (PART ONE) 6.06 Multiply two integers INTRODUCTORY ALGEBRA (PART TWO) 3.04 Express a fraction as a terminating or a repeating decimal GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number 4.10 Change a fraction to a decimal

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SELECTED TEACHER HELPS

VOCATIONAL EDUCATION COURSE Energy and Power Technology

026

INSTRUCTIONS TO STUDENTS: Circle the letter choice that best describes the correct answer.

A fast way to determine if the carburetor is not functioning correctly is to:

a. wet thumb method
b. adding fuel directly to cylinder
c. a and b
d. replace gas method

A dry element type air is cleaned only by:

a. using compressed air
b. tapping against hand
c. pass lighted 50 watt bulb in center of filter to check for hole tear
d. b and c above

Engine manufacturers recommend that oil should be changed every:

a. 50 hours
b. 25 hours
c. month
d. two months

What should be done if a cylinder does not meet taper and out of round specification.

a. replace blank
b. replace to 10-20-30 oversize
c. purchase special piston rings
d. need more information before a proper decision can be made

The three engine parts that must be removed to get at the valves are:

a. shrouding, head, valve cover
b. flywheel head and valve cover
c. valve cover, carburetor, and head
d. head, valve cover and camshaft

If the points are badly pitted one repairs by:

a. filing
b. replacing points
c. replacing points and condenser
d. replacing condenser

Why is cylinder wear greater at the top than at the bottom?

a. the side thrust of the piston against the wall
b. the pressure of the piston rings against cylinder wall
c. more oil at the top causing greater heat
d. there is a greater amount of abrasive dust at the top

What can be done to repair a loose fitting piston pin.

a. replace with oversize pin
b. purchase new piston and pin
c. replace with new piston
d. all of the above

The valve face and seat are repaired by:

a. grinding
b. cutting
c. polishing
d. none of the above
e. a and b above

What device is used to check an operating engine for power output?

a. dynamic balance
b. dynamometer
c. multigauged balance
d. thermodynamic gauge

INSTRUCTIONS TO STUDENTS: Answer the test item by writing correct information in the space provided.

What part of the ignition system must be adjusted after installing the flywheel on a Briggs engine?

Air gap between armature coil and flywheel magnet

INSTRUCTIONS TO STUDENTS: Put in order (1, 2, 3) the procedure for disassembling a small engine's ignition system.

Procedure	Order
remove flywheel	4
remove condenser and points	5
remove shrouding	3
disconnect spark plug wires	1
remove spark plugs	2

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 027 01. Demonstrate use of torque wrench to tighten nuts and bolts to specified torque. 02. Use vibration tachometer.	027 Name and demonstrate how selected small internal combustion engine hand tools and repair and diagnostic equipment are safely used. SKILLS: Decimals Multiplication	GRADE 7 1.01 Read word names for whole numbers containing as many as seven digits 1.02 Read and write the numeral for any whole number less than ten million GRADE 8 2.01 Read and write numbers with as many as three decimal places 2.08 Multiply two decimal numbers GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers

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VOCATIONAL EDUCATION COURSE: Energy and Power Technology

027

INSTRUCTIONS TO STUDENTS: Answer the test item by filling in the blank.

The tool used to tighten bolts and nuts to specification (inch pounds/foot pounds) is called a:

torque wrench

INSTRUCTIONS TO STUDENTS: Answer the test item by filling in the blank.

The tool used to assemble piston and rings into cylinder is a ring compressor

INSTRUCTIONS TO STUDENTS: Circle the letter that best describes the correct answer.

What is a device used to seat a valve to its seat in an engine?

a. valve stick

(b.) lapping stick

c. compressor stick

d. seating stick

INSTRUCTIONS TO STUDENTS: Circle the letter that best describes the correct answer.

What device is used to check a spark plug under pressure?

a. spark tester

(b.) spark plug cleaner and compression tester

c. ignition tester

d. continuity

INSTRUCTIONS TO STUDENTS: Answer the test item by filling in the blank.

A device used to check engine RPM, based on engine power strokes, is known as a vibration tachometer tachometer.

INSTRUCTIONS TO STUDENTS: Circle the letter that best describes the correct answer.

What is the special device used to test the ignition system parts?

a. amature tester

b. points tester

c. thickness gauge

(d.) coil and condenser checker

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
030 01. Utilize pneumatic (air) and hydraulic (fluid) to operate a brake system.	030 Identify and apply the principles of fluidics (hydraulic and pneumatic) in obtaining mechanical conversion. SKILLS: Multiplication Division	GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number

VOCATIONAL EDUCATION COURSE Energy and Power Technology

030

INSTRUCTIONS TO STUDENTS: Fill in the blank space with correct information to complete the sentence.

Pneumatics use air and/or gases to make mechenical work easier, while hydraulics use fluids for the same purpose.

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in the correct information in the space provided.

List two examples of pneumatic systems:

1. Any two: brakes on trains, tires on cars, spray paint, die casting, etc.
2. _____

INSTRUCTIONS TO STUDENTS: Write a brief statement to correctly answer the test item in the space provided.

How does hydraulics aid in a mechanical situation? lifting, lowering, moving, multiply and increase forces.

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 032 01. Use Ohm's law and impedence in measuring power.	032 Identify electrical processes and means of converting energy into useful power. SKILLS: Multiplication Division	GENERAL MATHEMATICS 11.06 Find the missing term in a formula when sufficient information is given

VOCATIONAL EDUCATION COURSE Energy and Power Technology

032

INSTRUCTIONS TO STUDENTS: Place a number beside each statement in the space provided to indicate the sequence of producing electricity.

4 high voltage transmission lines

1 mechanical energy to generator

3 conduction to slip rings and brushes

5 transformer

6 small transformer

2 rotation of magnetic field

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

List the sequence of transferring power from the electrical generating plant to you.

1. Power is first generated
2. Electricity is forced out through high voltage transmission lines
3. Transformers from the line reduce voltage
4. Voltage is further reduced by small transformers to homes

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

Electro-generators are driven by:

1. steam
2. hydroelectric power
3. wind

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
036 01. Discuss solenoid, relay, transformer, laser, etc.	036 Identify, demonstrate, and give applications for at least six (solenoids, relays, transformers, deflection, laser, etc.) magnetic means of converting electrical energy. SKILLS: Multiplication Division Decimals	GRADE 7 1.01 Read word names for whole numbers containing as many as seven digits 1.02 Read and write the numeral for any whole number less than ten million GRADE 8 2.01 Read and write numbers with as many as three decimal places 2.08 Multiply two decimal numbers GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 11.06 Find the missing term in a formula when sufficient information is given

VOCATIONAL EDUCATION COURSE Energy and Power Technology

036

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

Identify four devices for converting electrical energy by magnetic means.

1. any four: solenoid
2. relay
3. transformer
4. deflection
   laser, etc.

INSTRUCTIONS TO STUDENTS: Of the devices listed in test item 036-00-01 above, choose two and explain how they convert electrical energy by magnetic means.

Devices	Explanations
1.	Students may choose two devices and explain their conversion based on
2.	information covered in class

INSTRUCTIONS TO STUDENTS: Write a brief explanation to answer the following test item in the space provided.

In what way(s) are a solenoid and a relay similar?

Both work on magnetic principle, both are considered switches.
Solenoid can be used as a mechanical switch, e.g., turning water off and on or an automatic clothes washer.

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 037 01. Define resistance and explain computation of same.	037 Demonstrate how to construct and control selected electric devices through the process of electrical conversion (resistance, electromagnetic, electrolytes, and electrostatic). SKILLS: Multiplication Division Decimals	GRADE 7 1.01 Read word names for whole numbers containing as many as seven digits 1.02 Read and write the numeral for any whole number less than ten million GRADE 8 2.01 Read and write numbers with as many as three decimal places 2.08 Multiply two decimal numbers GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 11.06 Find the missing term in a formula when sufficient information is given

SELECTED TEACHER HELPS

VOCATIONAL EDUCATION COURSE Energy and Power Technology

037

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the following test item.

Resistors are used in a circuit to:

a. increase voltage

(b.) control current and drop voltage

c. give off ions

d. creates voltage

e. none of the above

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the following test item.

A pastelike substance in a cell that causes a chemical reaction is called:

a. reduction

b. electricity

(c.) electrolyte

d. electrolysis

e. none of the above

INSTRUCTIONS TO STUDENTS: Answer the test item by writing correct information in the space provided.

Identify two home and two automobile devices that are controlled by electromagnetic means.

Home	Automobile
1. refrigerator door closing	horn
2. washer spin cycle	starter
	air conditioner compressor

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
041 01. Read thermometer and graduation of mercury flow from freezing to heating temperature.	041 Demonstrate how selected thermal energy conversion devices function (e.g., thermostat, thermometer, thermocouple). SKILLS: Read thermometer	GRADE 7 7.05 Determine temperature by reading a thermometer GRADE 8 6.05 Read temperature from a Celsius or Fahrenheit thermometer

VOCATIONAL EDUCATION COURSE Energy and Power Technology

041

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

What produces electricity in a thermocouple:

a. magnets

b. two unlike metals

c. light

d. ions

e. none of the above

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

What contains a sensor that controls temperature by shutting on and off current:

a. thermometer

b. thermostat

c. thermocouple

d. thermal cell

e. none of the above

INSTRUCTIONS TO STUDENTS: Write a brief explanation to correctly answer the test item in the space provided.

How does a thermometer work? Liquid in a thermometer expands when heated and contracts when cooled

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
042 01. Explain uses of solar cells.	042 Identify and describe common application of radiant processes of energy conversion (e.g., photoelectric-light to electricity, heating-warm to hot solar). SKILLS: Measurement Multiplication Division	GRADE 7 1.01 Read word names for whole numbers containing as many as seven digits 1.02 Read and write the numeral for any whole number less than ten million 7.05 Determine temperature by reading a thermometer GRADE 8 2.01 Read and write numbers with as many as three decimal places 2.08 Multiply two decimal numbers 6.05 Read temperature from a Celcius or Fahrenheit thermometer GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 11.06 Find the missing term in a formula when sufficient information is given

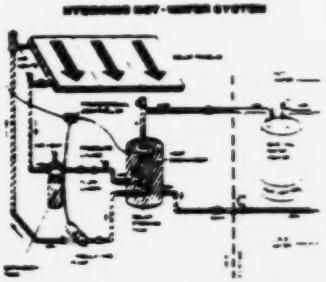
VOCATIONAL EDUCATION COURSE Energy and Power Technology

046

INSTRUCTIONS TO STUDENTS: Follow directions as given and make your drawing on a separate sheet of paper.

Draw a simple picture of what a 'series' solar hot water heater looks like and list the materials needed to build one.

Drawing should look similar to this one

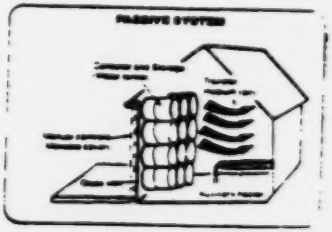


Materials list: copper tubing
wood or other material for case
plastic pipe to connect copper tubing
glass or transparent material for front
insulation, flat black paint

INSTRUCTIONS TO STUDENTS: Follow directions as given and make your drawing on a separate sheet of paper.

Draw a simple picture of a passive solar collector designed to heat air. Identify materials of construction.

Drawing should look similar to this one



Materials list: glass or transparent material for front
wood or simlar
insulation
flat black paint
tubing for air vents (ingoing and outgoing)

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

What components would you add to a passive solar system to make it an active solar system?

controls and blowers

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
047 01. Define peak load. 02. Define Wonk formula for determining. 03. Define KWH cost.	047 Discuss consumerism as a purchaser-user of selected energy conversion techniques. SKILLS: Multiplication Division	GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number

VOCATIONAL EDUCATION COURSE Energy and Power Technology

042

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

Photocells contain an element that allows electrons:

a. to be freed by light

b. to begin combustion

c. to be destroyed by light

d. to double voltage

e. need more information

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

List five uses for solar cells.

1. any five: produce electricity
2. water purification
3. remote radar
4. battery charging
5. portable radios, telephone, photography, light meters, etc.

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

List three applications of energy conversion through radiant processes.

1. any three: sound track on movie film
2. heating of atmosphere,
3. photovolatic, photosynthesis, etc.

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
046 01. Construct a simple picture of what a series solar hot water heater looks like and list materials needed to complete.	046 Demonstrate how to design and construct passive/active solar collector systems using liquid/air as mediums for gathering and controlling the energy. SKILLS: Addition Multiplication Division Scaling	GRADE 7 2.02 Add any three 4-digit numbers 2.04 Subtract any two 4-digit numbers GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number ALGEBRA I 13.07 Find the sine, cosine, and tangent of the acute angles in a right triangle 13.08 Find the values for trigonometric functions for given angles 13.10 Use trigonometric ratios to solve problems

VOCATIONAL EDUCATION COURSE Energy and Power Technology

047

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

Where would you go to find information on consumerism as related to energy? (list 2 sources)

Any two; local power company, Dept. of Energy, consumer reports, library, local industrial arts teacher, etc.

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

Why is it important for you as a consumer of energy to be aware of conversion techniques?

To learn enough about energy conversion and conservation in order to make good consumer choices.

INSTRUCTIONS TO STUDENTS: List three energy saving tips for conserving energy (1) in and around the house, (2) on the road; and (3) in the marketplace.

1. Answers to this test item may vary. There is no wrong answer for this
2. question as long as the answer given is a valid energy saver tip. The
3. purpose of this test item is to make students aware of what they may do to conserve energy.

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
049 01. Compare amount of energy achieved by use of alcohol and wood. 02. Compare cost utilisation for both materials. 03. Compare cost effectiveness of each.	049 Explain the concept consumerism of purchaser-user of these other energy conversion techniques given in 048. (048 for reference use only) 048 Describe how biomass, waste, alcohol, geothermal, gravity, peat, and wood are converted to useful energy. SKILLS: Multiplication Division	GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number

VOCATIONAL EDUCATION COURSE Energy and Power Technology

049

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VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
053 01. Use Ohm's law to measure resistance. 02. Explain flow of electricity by using a switch to control current flow. 03. Use ohmmeter to measure current going into and coming out of transformer.	053 Identify and describe several examples of electrical and magnetic means (relays, galvanometer, ohmmeter, oscilloscope, switches and regulators, resistors, transformers, solenoids, contactors, indicators and deflection systems) for controlling power. SKILLS: Multiplication Division Fractions Measurements	GRADE 8 2.01 Read and write numbers with as many as three decimal places 3.01 Read and write fractions with more commonly used denominators, e.g., 2, 3, 4, 5, 6, 8, 10, 12, 20, 25, 50, and 100 GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number

VOCATIONAL EDUCATION COURSE Energy and Power Technology

053

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

Which are electrical measuring devices that can be used to control power?

a. thermostat, thermometer, switch

b. transformer, transmitter, transmission

(c.) galvanometer, ohmmeter, oscilloscope

d. a and c above

INSTRUCTIONS TO STUDENTS: Place a check (✓) beside factors that are used to control electrical power.

✓ relays

___ thermometer

___ galvanometer

✓ switch

✓ resistor

___ gases

___ liquids

___ chains

✓ solenoid

INSTRUCTIONS TO STUDENTS: Match the electrical terms to correct descriptions by placing the correct letter by each number.

Terms	Descriptions
D ... 1. relay	a. insulators
B ___ 2. resistor	b. resist the flow of electricity
E ___ 3. transformer	c. moves electricity in straight line motion
A ___ 4. transistor	d. to control a circuit from remote source
G ___ 5. fuse	e. changes voltage and amperage
C ___ 6. solenoid	f. controls direction of current flow
H ___ 7. contactors	g. opens when too much current passes through
	h. indicates something is wrong

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 055 01. Demonstrate smoke detection. 02. Demonstrate a galvonometer. 03. Demonstrate a geiger counter.	055 Identify several examples of controlling energy/power through chemical-nuclear means (smoke detection, galvonometer, geiger counter). SKILLS: Multiplication	GRADE 7 1.01 Read word names for whole numbers containing as many as seven digits 1.02 Read and write the numeral for any whole number less than ten million 4.08 Multiply a whole number and a number with no more than three decimal places GRADE 8 2.01 Read and write numbers with as many as three decimal places GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers

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055

INSTRUCTIONS TO STUDENTS: Circle the letter choice which correctly answers the test item.

A smoke detector produces a reaction by sensing a (an):

a. need more information

b. moisture change

c. temperature change

(d.) air change

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

A galvanometer is sensitive to:

(a.) air pressure

b. temperature

c. radiation

d. none of the above

INSTRUCTIONS TO STUDENTS: Write one or two sentences explaining the answer of the following test item.

Explain how a geiger counter works?

Contain a sensor that picks up rays of radiation given off by active material

CURRICULUM ALIGNMENT CHART

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VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 058 01. Calculate the number of solar collectors needed for a given house. Given: house size, roof pitch, latitude, size of collector, area of surface covered, collector requirements for area, and formula--collector area covered X number in family = X (X) XB = number of square feet	058 Explain how to calculate liquid solar collection units required for a family of four. SKILLS: Multiplication Division Addition	GENERAL MATHEMATICS 2.01 Add two 4-digit numbers 2.04 Subtract two 4-digit numbers 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number

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058

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

What determines the flat plate collector area needed to heat enough water for a family?

a. size of family

b. degree heating days

c. days of sunshine

d. efficiency of collector

(e.) all of the above

INSTRUCTIONS TO STUDENTS: Write a brief statement to correctly answer the test item.

Why is it important to consider the geographic location when calculating flat plate collector area needed for heating water for a family?

The temperature and amount of sunshine relates directly to the ability of a flat plate collector to produce hot water

CURRICULUM ALIGNMENT CHART

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VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
059 01. Determine BTU collected, amount of insulation, and square feet coverage. 02. Determine energy efficiency = $\frac{\text{output}}{\text{input}}$ X 100.	059 Demonstrate heating efficiency of two different solar flat plate liquid collectors. SKILLS: Multiplication Division Addition Subtraction	GENERAL MATHEMATICS 2.01 Add two 4-digit numbers 2.04 Subtract two 4-digit numbers 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number

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059

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

What factors are considered in determining the efficiency of a collector?

a. BTU's collected
b. amount of insulation
c. square footage of collector plate
(d.) all of the above

INSTRUCTIONS TO STUDENTS: Write the formula for a simple energy efficiency equation in the space provided.

Efficiency = $\frac{\text{Eff} = 800 \times 100}{400} = 2 \times 100$ E = 20%

INSTRUCTIONS TO STUDENTS: Calculate efficiency based on information provided.

Calculate the efficiency of a flat plate collector which has 800 BTU's per hour output and 400 BTU's per hour input.

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
060 01. Place collector at 10° + long. 10° + 15° west of true south.	060 Demonstrate how to place a flat plate collector to gain maxium all-day radiant efficiency. SKILLS: Degrees Addition	GRADE 7 4.06 Add three numbers, each having no more than three decimal places GRADE 8 2.04 Add decimal numbers GEOMETRY 1.08 Use a protractor to find the measure of an angle

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060

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

The best angle to set a flat plate collecter is:

a. 10° plus longitude

(b.) 10° plus latitude

c. 5° plus longitude

d. 5° plus latituce

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

The most effective direction at which to aim your solar collector array to gain the best all day temperatures is about:

a. 5° to 25° south of true west

(b.) 10° to 15° west of true south

c. 10° to 15° south of true west

d. 5° to 25° west of true south

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in the correct information in the space provided.

The best location to place a solar collector for maximum efficiency is roof top

CURRICULUM ALIGNMENT CHART

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VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 062 01. Draw a picture of a heat grabber installed in a window.	062 Demonstrate how to construct an air heat grabber and install in a structure. SKILLS: Scaling Dimensioning Division Fractions Measurement	GRADE 8 3.10 Multiply two proper and/or improper fractions 3.11 Find the quotient of two fractions GENERAL MATHEMATICS 2.08 Divide a 4-digit number by a 2-digit number HEATH LEVEL 6 9-6 Measure lengths with a 1/16-inch ruler

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062

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in correct information in the space provided.

Where is the best place to install a heat grabber? in a southern window that has access to sunshine

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

The natural process which air flows through a heat grabber is based upon the principle of:

a. convection
b. radiation
c. insulation
d. conduction

INSTRUCTIONS TO STUDENTS: Answer the following test item by illustrating your design on a separate sheet of paper.

Draw a picture of an air heat grabber installed in a window.

Students drawing should look similar to this one:

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
077 01. Calculate heat loss using prescribed formula Heat loss (BTU / hour) = total area X H.L. multiplier.	077' Demonstrate how to calculate heat gain and loss in a home energy audit. SKILLS: Multiplication	GENERAL MATHEMATICS 2.06 Multiply two 2-digit numbers

077.

INSTRUCTIONS TO STUDENTS: Answer the following test item based on information provided:

The heat loss is calculated by

heat loss (BTU/hr) = total area x H. L. multiplier

Heat loss multipliers used for heat loss calculations:

Outside temperature (°F)	-30	-20	-10	0	+10	+20
Sidewalls: Frame or brick						
no insulation	26	23	21	18	16	13
2" fiberglass	13	12	10	9	8	7
3 1/2" fiberglass	7	6	6	5	4	4
Windows:						
single glazing	113	102	90	79	68	57
double glazing	69	62	55	48	41	35
Doors:						
1 1/2" solid wood	49	44	39	34	29	25
1 1/2" solid wood with aluminum storm door	33	30	26	23	20	17
Ceilings: (with attic above)						
no insulation	32	29	26	22	19	16
3 1/2" fiberglass	8	7	7	6	5	4
6" fiberglass	5	5	4	4	3	3
10" fiberglass	3	3	2	2	2	2
14" fiberglass	2	2	2	2	1	1

What is the total heat loss for a building with the following specifications:

1. outside temperature (+20)
2. walls have 3 1/2" insulation
3. windows (double glazing)
4. door 1 1/2" solid wood
5. ceiling 6" fiberglass insulation
6. area size:

384 sq. feet total
- 20.5 door
- 12.5 window
351 sq. footage

351 x 4 (sidewalls) = 1404 BTU's lost
12.5 x 35 (window) = 437.5 BTU's lost
20.5 x 25 (door) = 572 BTU's lost
2353.5 BTU's per hour lost

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item:

The coefficient of heat transfer is expressed as:

a. R
b. U
c. K
d. T

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

What is the thermal resistance (R value) of a 3 1/2" fiberglass insulation material that has a coefficient of heat transfer (U-value) of 97

a. 208
b. 118
c. 108
d. 88

CURRICULUM ALIGNMENT CHART

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VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
078 01. Conduct an energy audit and set up a budgeting and accounting system for energy usage.	078 Identify and describe systems of home energy management. SKILLS: Multiplication Division	GENERAL MATHEMATICS 2.01 Add two 4-digit numbers 2.04 Subtract two 4-digit numbers 2.06 Multiply two 2-digit numbers 2.08 Divide a 4-digit number by a 2-digit number

078 VOCATIONAL EDUCATION COURSE Energy and Power Technology

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

An energy management plan means:

a. energy audits
b. retrofit applications
c. budgeting and accounting energy usage
(d.) all of the above

INSTRUCTIONS TO STUDENTS: Answer the following test item by writing in the correct information in the space provided.

What energy supply system in the home can be managed to save energy? gas and electricity

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

What specific activities can a person do in a home to manage the use of energy?

a. turn back thermostats
b. cut back water temperature
c. take shorter hot showers
(d.) all of the above

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Energy and Power Technology

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS		
079 01. Determine "R" value of different insulating materials.	079 Describe (R) factor and its relation to insulating qualities of building materials needed for different heating zones in the U.S. SKILLS: Multiplication Division	GRADE 8 2.01 Read and write numbers with as many as three decimal places

079 VOCATIONAL EDUCATION COURSE: Energy and Power Technology

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item

"R" value is:

a. the resistance to air flow
b. the rate of heat transfer
(c.) the resistance of energy flow

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

Insulation quality is usually based on the amount of:

a. glass
b. vapor barrier
(c) air space within the insulation

INSTRUCTIONS TO STUDENTS: Circle the letter choice that correctly answers the test item.

R-values required for insulation of ceilings, walls and floors of a home are identified by:

a. geographical location
b. cost of energy
c. type of energy used for heat
(d) A and C

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